Chapter 5

Main Line Operations and Procedures

Main line operations and procedures are complex. They involve the movement of freight, passenger, and mixed (freight and passenger) trains from one terminal or yard to another over a division or subdivision of track. In addition to their complexity, main line operations are a prime target of enemy NBC weapons. Contingency plans must be developed with the capability and flexibility to continue main line operations in an NBC environment.

TRAIN OPERATING COMPANY PERSONNEL

5-1. In military railroading, the train operating company of the transportation railway battalion provides crews for operating locomotives and trains. These crews operate either freight or passenger trains over a main line or engines in rail yards. Certain terms are used to distinguish between crews. Use of the terms "yard crew" and "road crew" refers to the crew's place of employment. The term "ground crew" applies to a yard conductor and his brakemen.

5-2. A road crew normally consists of the following:

- Conductor.
- Locomotive engineman.
- Senior brakeman.
- Brakeman.

If steam motive power is used, a fireman will be added to the crew. One of the two brakemen normally assigned accompanies the engine or rides the train near the head end. He is known as the forward or head brakeman. The other brakeman is permanently assigned to rear-end flagging duties. The rear brakeman is known as the flagman. A third brakeman may be assigned when the work load demands his service. The engineman and the fireman (if one is assigned) are called the engine crew. The rest are known collectively as the train crew. The conductor is in charge of the full crew (both trainmen and enginemen).

5-3. Military railroads in theaters of operations often needs armed security guards to accompany a train to help protect shipments against pilferage. Such personnel are not a part of the crew. All personnel will have their MOPP equipment with them during main line operations.

CALLING AND REPORTING

5-4. When a road crew is called for duty, each member should receive a written or a verbal notice giving the time called, the train's destination, and its type or symbol number. Depending on the distance they are from their duty stations, crews receive notice from 1 to 2 hours ahead of the time that they are called for work.

5-5. Upon reporting for duty, crew members sign a register and read and sign an acknowledgment of any newly posted general orders or bulletins that may affect operations over the portion of railroad their train will travel. They are told the engine number for the trip. Crew register offices have standard clocks with which all crew members must synchronize their watches. The conductor finds out from the yardmaster the track number the train is on and what track the road engine is to use to go to that track.

TRAIN CREW DUTIES

5-6. The locomotive engineman (or engineer) operates the locomotive and runs the train according to the following:

- Operating rules.
- Timetable.
- Train orders.
- Other general notices or directives.

Although a locomotive located "first out" on a ready track is practically guaranteed to operate properly, the engineman should inspect the fuel, sand, water, and lubricating and valve oil. He should also inspect and oil (if necessary) the running gear of the locomotive. The engineman and the head brakeman move the locomotive or road engine from the ready track to the departure yard. A hostler is a person who moves engines around yards and enginehouse areas. On some railroads, a hostler may take the engine from the ready track to the yard track.

5-7. The brakemen line switches at their respective ends of the train. They couple and uncouple cars, connect and disconnect air hoses, set hand brakes, and relay hand signals (as does the conductor). The brakemen also takes every opportunity to inspect the train for malfunction of equipment or shifting of cargo.

5-8. The senior or head brakeman gives signals (by hand, lantern, flag, or verbal orders) for the movement of trains. He should ride on or near the engine for the entire trip and do all front-end flagging. He repeats signal aspects as the engineman calls them to ensure that concerned personnel are reading them the same way. The head brakeman observes trains for any errors that may be displayed in signaling.

5-9. When the head brakeman and engineman take a road engine from the ready track, they bring it to the departure yard and back it against the train. After the engine is coupled to the first car of the train, a road test should be made of the air brake system. Signal flags identifying the class of the train are mounted when required.

5-10. The flagman checks his flagging equipment (which includes flags, fuses, torpedoes, and lanterns with red and white lights). He mounts the marker lanterns, disks, or flags on the rear car to give the train official standing, after it is on the main line.

5-11. The conductor is responsible for the whole train. The conductor compares watches with the engine crew and briefs them on the orders they hold and the work they will do en route. He reports to the yard office for waybills and train orders governing his trip on the main line. The conductor performs the following at the yard office:

- Checks the waybills against the train consist.
- Prepares the wheel report.
- Supervises the disposition of cars set off.
- Surveys accidents or mechanical failure of equipment (including reporting damages or delays).

The conductor, along with the other crew members, observes signals from towers, stations, and from other trains. He receives and acts on any additional train orders en route. The engineman will not move the train until he receives the signal from the flagman to depart. When the train leaves the yard and enters the main line, the dispatcher controls its movement. However, the conductor must see that his train runs according to operating rules and that it does not run ahead of time.

5-12. If the train is not a through train, the conductor will usually make a penciled lineup and call the dispatcher regarding setoffs en route. The dispatcher may tell the conductor what stations have pickups for the train. If both telephone and dispatcher circuits exist, the conductor may call two or three stations ahead. When contacting a distant yardmaster or station agent, the conductor does the following:

- States what cars he has to set off and determines on which tracks they should be placed.
- Determines what cars will be picked up; the track number; and, if pickup will be some distance from the yard office, the location of the waybills and wheel report. When a train must pick up cars some distance from a yard office, the waybills may be delivered to the moving train by a message hoop to prevent the train's stopping twice. If weighted and protected against bad weather, bills may be left on the end of the first car of the pickup.

- Asks the yardmaster where waybills should be left if the train is setting off cars some distance from the yard office. A yard receiving a setoff of only a few cars may station someone along the track to catch waybills thrown off the moving engine. Bills should be wrapped securely around a rock or other heavy object to prevent the possibility of a vacuum drawing them under the car wheels.

DEPARTURE PROCEDURES

5-13. Before a train leaves the yard, the crew makes a road test of the air brake system. Upon coupling the locomotive to the train, the engineman starts the locomotive's air pumps to bring the trainline or brake-pipe pressure within not less than 5 pounds below the standard pressure prescribed for the train. When this figure is reached, the flagman signals the engineman to apply the brakes and to reduce pressure by 15 pounds on the brake-pipe gauge. This is called a service reduction. The amount of brake-pipe leakage must not exceed 5 pounds per minute as noted on the brake-pipe gauge. When the brakes are applied, it indicates the flow of air is uninterrupted on the entire length of the train. A signal is then given to release the brakes. After this test, the reduction must be increased to 25 pounds. If the brakes apply and release, it is assumed that they have performed the same on the entire length of the train. This assumption is based on the fact that car inspectors have previously made a terminal air test and have walked the entire length of the train to ensure the brakes have applied and released on all cars. If car inspectors are not on hand, a conclusive air test can be made by a crew member walking beside the train and observing each car. After the air test, and if train-line or brake-pipe leakage is within permissible limits, the train is ready to pull.

5-14. At the head end, the conductor will brief the head brakeman and engineman on the type of train and at what yards they will have setoffs and pickups. He will advise the head brakeman how to handle waybills at each stop and will pass verbal orders from the dispatcher. If there are many stops to be made or if instructions are involved, instructions may be given in writing. Waybills and sections of the wheel report for cars that will be set off en route are given to the head brakeman. Through waybills are kept by the conductor for additional clerical work.

LOCOMOTIVE INSTRUMENTS AND CONTROLS

5-15. The engine crew assumes the chief role in the safe and expeditious progress of a train on the main line. A number of locomotive controls are used to keep a train running smoothly, speedily, and safely. The objective of the engine crew is to take the train over the road safely in the scheduled time, using the least amount of fuel with minimum wear on the rail equipment.

5-16. The engineman's principal controls on a diesel-electric locomotive are as follows:

- Throttle lever that regulates the engine's speed.
- Reverse lever that controls magnet valves in the reverser.
- Independent and automatic brake valves that control the locomotive brakes only, and locomotive and car brakes, respectively.

Miscellaneous controls such as the horn, bell ringer, sander, deadman pedal, and a control switch to connect the control circuits to their source of power are also controlled by the engineman.

AUTOMATIC SIGNAL SYSTEMS

5-17. Railway signals are devices, indications, and signs that control the movement of trains along tracks and into and out of stations, terminals, and yards. These signals may be given by hand or by a complex, automatically operated electrical system. Signals may be fixed such as whistle posts, speed, and yard limit signs.

BLOCK SIGNAL SYSTEM

5-18. The automatic block signal system permits faster train speeds than any other signal system. It is designed to maintain predetermined intervals between trains by means of the track circuits and appropriate electrical equipment activated by the trains. A section of track is divided into blocks; each block is governed by a three-position light or semaphore signal. An approach aspect displayed in each block indicates the situation in the next (succeeding) block. Therefore, each train is protected to its rear by a signal indicating that the following train must proceed at restricted speed and be prepared to stop if the block is occupied. The system may be used on single- or multiple-track to control following or opposing trains. On single-track routes, controlled movement, from siding to siding, sustains opposing traffic flow.

CENTRAL TRAFFIC CONTROL

5-19. A refinement of electric or pneumatic interlocking, this system permits the moving trains through an extended area (200 to 300 miles) over tracks and blocks controlled from a distant point. Division dispatchers have control over all switches and signals in the area. On a panel board or wall before them, they have an electrically lighted diagram that shows all locomotive or train locations, switch positions, and signal indications on the controlled sections of track. Using a control machine, they can change switch positions and signal indications as required.

INTERLOCKING PLANTS

5-20. Foreign railroads often use interlocking plants and/or switch towers. Unit personnel may be required to control, operate, and maintain them in a phase I operation or to furnish supervisory personnel in phase II and III operations. Conditions in a theater of operations seldom are stable enough to justify installation of new interlocking plants. However, if possible, existing plants should be used in areas of heavy traffic. Figure 5-1 contains a list of definitions that personnel should be familiar with in order to understand further discussion.

Control tower (interlocking station) -- The place from which the interlocking plant is operated.
Interlocking machine -- An assembly of manually operated levers or push buttons used to control mechanically or electrically operated lights, signals, switches, derails, and other units.
Electric lock -- A device which prevents movement of a lever, switch, or other moveable object until properly released.
Foundation -- A fixed support for signal devices.
Lead out -- Mechanical connections between the interlocking machine and outside equipment.
Pipelines -- Connections made with pipe or tubing and the supporting apparatus leading from the operating lever to the operated unit.
Switch mechanisms -- Fittings for equipping a switch.
Signals -- Home, distant, and dwarf signals of an interlocking plant.

Figure 5-1. Definitions

Operation

5-21. Interlocking plants may be operated manually, electrically, or electro-mechanically. The interlocking machine consists of a series of devices (so interconnected that they can be manipulated and operated only in a predetermined order) which control traffic from a central point by operating a series of signals and switches. Latches in the control levers activate interconnecting bars, crosslocks, and dogs that prevent incorrect order of operation. A lever in the machine or a button in the control panel regulates all signals and switches of that particular interlocking. The switches and signals are interlocked electrically and mechanically to ensure that the proper signal is displayed for a specific route and that the switch points match the displayed aspects.

Location

5-22. An interlocking plant is centrally located in a large terminal or junction at a point of maximum visibility. Specifically, interlocking installations usually are found at the following:

- Entrance or exit of large freight and passenger terminals.
- Large receiving, classification, and switching yards.
- Railroad crossings for trains traveling in different directions or for trains of different railroad lines.
- Junctions with the main line.

Inspection and Maintenance

5-23. Since railway signaling equipment is complex and varied in design, concise instructions covering its maintenance and repair cannot be included within the scope of this FM. Manufacturer's manuals contain specific details of construction and design. In oversea theaters, these publications normally are not available for the signal equipment that rail units may encounter. Therefore, whether or not this equipment can be used depends on its similarity to American equipment, the possibility of repair or replacement with like items, and the ingenuity of rail signal personnel. Maintenance required is directly related to the quality and frequency of inspection. Constant, careful inspection and testing greatly reduce maintenance requirements.

Safety Procedures

5-24. When defective elements or parts of a signal system are removed, the signal devices must be arranged to display the most restrictive aspects. Under no circumstances should agents, operators, or train personnel make any but the most minor repairs. Railway signal equipment is intended to provide the fastest train movement possible under safe operating conditions. If repair is not rigidly controlled, signal equipment deteriorates until it becomes unreliable and unsafe.

SIGNALS AND MARKERS

5-25. The three fundamental aspects to all railway signaling are: stop, caution, and proceed. The following describes the signals and markers used in railway operations.

FIXED SIGNALS

5-26. Fixed signals are defined as any signals of fixed location that affect the movement of a train or engine. They may be in many sizes and shapes. The three basic fixed signals that are commonly found are semaphore, color light, and position light (see Figure 5-2). Aspects of fixed signals are shown by the position of semaphore arms, color of lights, position of lights, or a combination of color and position of lights.

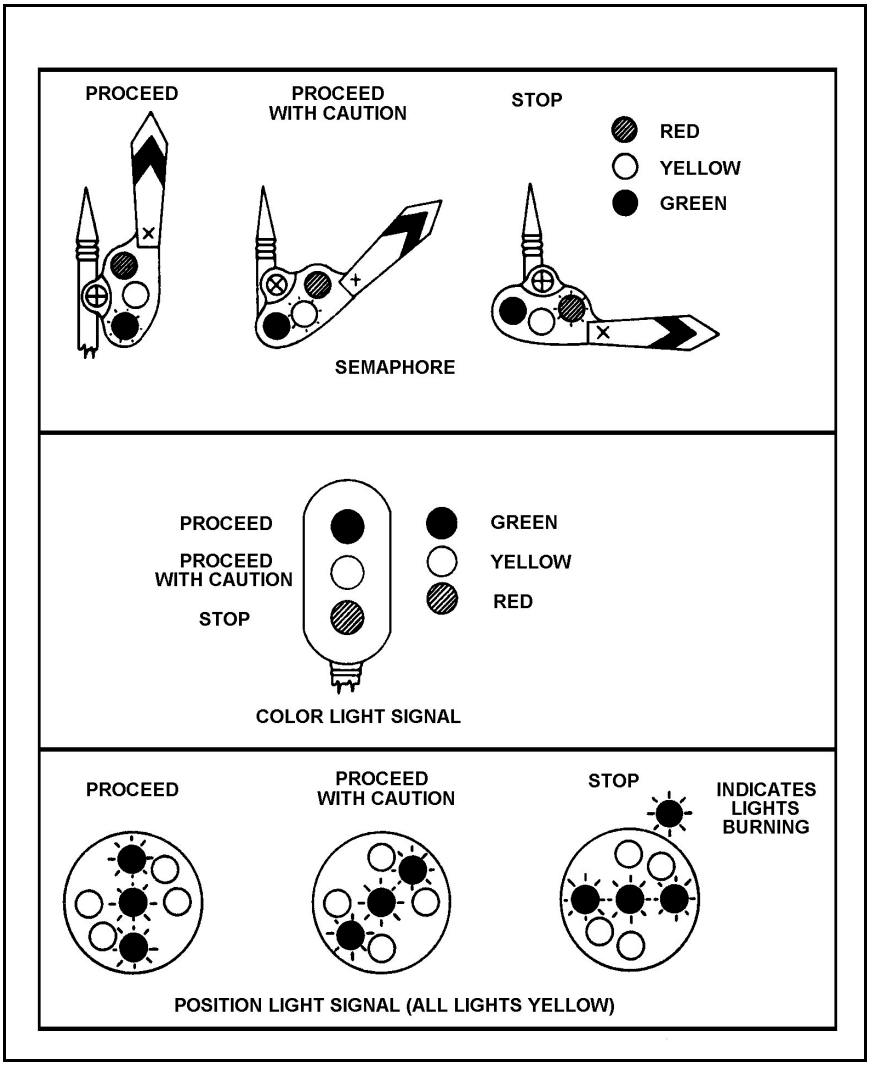


Figure 5-2. Fixed Signals

Semaphore

5-27. The semaphore consists of an arm or blade secured by a moveable mechanism to a vertical pole or mast. When the arm is in a vertical position (straight up) the train may proceed. When it is in a horizontal position (straight out from the post) the train must stop. If the signal is in approximately a 45-degree angle (between straight and straight out) the train may proceed with caution at a reduced speed. If the signal is in any position other than the three named positions, the train must stop. A signal imperfectly displayed or the absence of a signal must be promptly reported to the train dispatcher. This measure protects against defective signals endangering the movement of trains. During nighttime operations, the semaphore also has lights that can be seen as the arm is raised or lowered.

Color Light

5-28. The color light signal has three lights: red, yellow, and green. It is similar to traffic-control lights at street intersections.

- The train must stop if the light is red.
- The train may proceed if the light is green.
- The train may proceed with caution, but at a reduced speed, if the light is yellow.

As a safety precaution, the train must stop if two or more lights are burning at the same time or if all the lights are out.

Position Light

5-29. The position light signal is used extensively worldwide. Therefore, it is likely to be present in a theater of operations. This signal has yellow lights arranged in a circular pattern around a central light that burns in rows representing semaphore arm aspects. A vertical row of lights mean proceed; the next two blocks are clear. A diagonal row means proceed with caution at reduced speed; the next block is clear, but the one beyond it is occupied. A horizontal row means stop; the next block is occupied. The position of the lights rather than their color denotes the command signal. Any combination of light positions other than those stated means to stop.

SIGNALING PROCEDURES

5-30. As a train leaves the yard, the engineman should begin calling and repeating signals. The engineman calls each signal indication along the main line by name. The head brakeman (or the fireman if steam active power is used) will answer the engineman as he reads the signal. All signal interpretations must agree between the engineman and head brakeman. Calling and repeating signals is essentially a safety measure.

5-31. Main-line tracks equipped with automatic block signals are divided into sections which have signals to show whether the two or more block sections immediately ahead are clear or occupied. You should try to space signals at uniform distances. However; curves, sighting distances, bridges, tunnels, traffic congestion, and speed limits frequently prevent this from happening.

5-32. The signal name, when it is first seen, is called and repeated. The engineman must watch the signal for possible changes until the train has passed the signal. Aspect 1 may change to a more restrictive aspect if a switch is opened in one of the two blocks immediately ahead. Aspect 2 cannot change to a more restrictive aspect unless a switch is opened between it and the next signal, but it may return to clear (aspect 1). Aspect 3 cannot change to aspect 1 without first changing to aspect 2, unless the train causing the indication has left the main track for a siding. The stop indication must be observed and the train must not pass.

5-33. For dispatching, the ideal arrangement for train movement is to have trains spaced so that no train will be hampered in its progress by the stop or approach signals caused by the train ahead. However, this is not always possible, but it is a condition that dispatchers should not forget.

5-34. Besides warnings, the engineman will use the locomotive whistle or horn for a variety of signals. Operating rules prescribe certain whistle signals that must be sounded in various circumstances. These whistle sounds include the following:

- Calling for signals from towers and stations.
- Whistling persons flagging a train in and out.
- Acknowledging signals from other trains.
- Calling attention to signals the train may be displaying for one or more sections.

The engineman must whistle for all public and private road grade crossings. The final whistle must be timed to occur when the engine is actually on the crossing.

CLASSIFICATION SIGNALS AND MARKERS

5-35. Even though markers are not signals, they do convey information about the train to operating personnel. Classification signals are placed on the front of the engine. These signals identify what type of train it is. The signals are flags during daylight hours and remain visible by the addition of lights at night. Flags and lights placed on the rear of the train are called markers. Every type of train must display markers to qualify as a train and to show that the train is complete.

Classification Signals

5-36. A regular train displays no classification signals in front unless it is being run in sections. The first (or leading) section of a regular train displays green flags by day and green lights by night on the front of the locomotive (Figure 5-3). Each section carries these same classification signals, except the last section, which carries none. For example, if a train is being run in three sections, the first two sections display the appropriate green classification signals and the last section runs as a regular train showing no classification signals in front. If there are only two sections, the first section displays the green classification signals; the second section does not. Extra trains are not run in sections. Extra trains always display white classification signals on the front of the locomotive (also shown in Figure 5-3). White flags are used during daylight; in addition, two white lights are used by night.

Markers on the Rear of Trains

5-37. Markers are displayed on the rear of all trains. Because train operation in a theater usually takes place on single-track main lines, the discussion of train markers is confined to single-track operation. The markers displayed on a train on the main line (see Figure 5-4) are red and green flags used by day and red and green lights used at night. When red lights are displayed on the rear, it means that the main track is obstructed. A following train must approach at reduced speed. When a train is in the siding and clear of the main track with the switch lined for a through main line movement, it displays green flags by day and, in addition, green lights by night on the last car of the train (see also Figure 5-4). A single engine authorized by train order to run as an extra train must display white classification signals on the front of the engine and markers on the rear.

Color Indications

5-38. Color signal indications are standard for all railroads. Not only does the position of a signal give information to a railroader, but the color of the signal also has a specific meaning. Table 5-1 lists standard color indications.

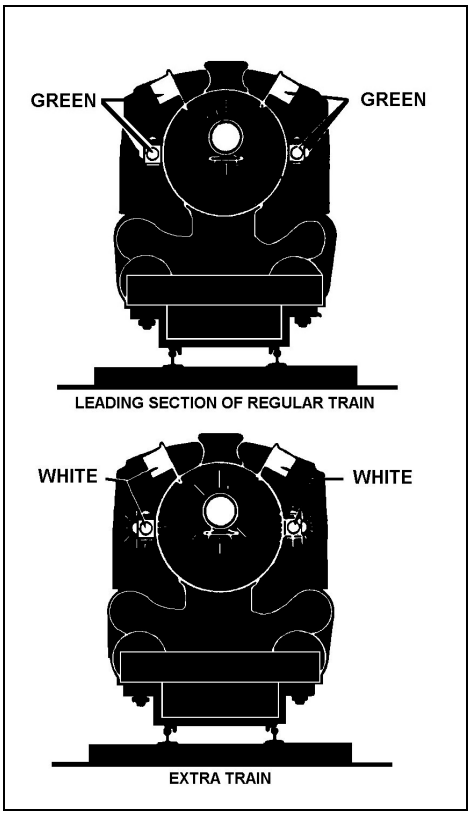


Figure 5-3. Train Classification Signals

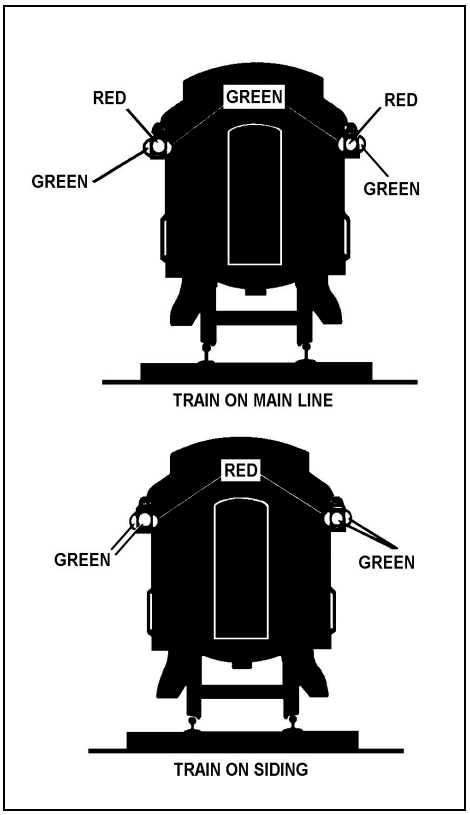


Figure 5-4. Rear Markers for Trains

Table 5-1. Standard Color Indications

Red	Stop.
Yellow	Proceed at restricted speed. Other uses prescribed by the rules.
Green	Proceed. Other uses prescribed by the rules.
Green and White	Flag stop.
Blue	Protect workmen.
Purple	Stop (indication for siding derails).

5-39. These colors may be displayed in different ways or by different devices. A yellow disk denoting a zone of restricted speed may have the authorized speed printed on it in black numerals. A blue metal disk on a portable stand by day or a blue lantern or blue light by night, are used as a signal by maintenance personnel. It is displayed at one end or at both ends of an engine, car, or train to show that workmen are under or above it. No one except the person placing the sign in position can remove it. A green and white signal near the right-of-way on an approach to a station means that the station is a flag stop. If no signal appears at the station, the train may continue without stopping.

NATO Train Identification

5-40. During operations in the NATO theater, identification symbols are assigned to trains to help standardize the procedures for moving forces within the territories of NATO nations of continental Europe. The procedures for obtaining these train identification numbers are found in AMovP4.

CLERICAL WORK AND CAR MOVEMENTS

5-41. Other duties that the crew is responsible for include receiving messages, making reports, and setting off and picking up cars en route.

MESSAGES

5-42. When a train is moving, the head brakeman must be on the lookout for messages at all open towers and telegraph stations. Messages are generally delivered "on the fly" by a message hoop, or loop, to which they are attached. The hoop is handed to the brakeman as he stands on the bottom locomotive step. He removes the message immediately and throws the loop to the ground as the train continues on its way. Messages may also be provided by radio if the locomotive is equipped. COMSEC procedures must be used at all times.

DELAY AND ACCIDENT REPORTS

5-43. If the train is delayed en route, the conductor records figures for a delay report, showing every stop the train makes. The information includes the time stopped, time started, elapsed time, reason for the stop, and exact location. Should the delay involve an accident; the time and date, weather, names and addresses of the injured, witnesses, and damage estimates must also be noted. This information is telegraphed in a separate report to the dispatcher or superintendent. When a stop is made and the conductor does not have enough time to get to the head end before the train starts up again, the head brakeman notifies the conductor of the reason for the stop before the delay report is filed.

CONDUCTOR'S WHEEL REPORT (DA FORM 5618-R)

5-44. The wheel report (see Figure 5-5) is a record of the train's run. It also contains most of the information shown on the train consist. The conductor prepares the report and completes the proper blanks to show the following:

- Train and engine numbers.
- Times of departure and arrival.
- Cars handled and where picked up and set out.
- Names of yards and stations where stops were made or the mileage/kilometer point if the place is undesignated.
- Names of the crew members.
- Unit designation in military railroading.

Any special comments are recorded in the Remarks column. At the end of the trip, the wheel report is completed and sent to the chief dispatcher or to the superintendent of work involved in setting off and picking up car service. Additional reports made by the conductor may include forms dealing with such freight as explosives, flammables, and perishables (see Figure 5-5). A blank copy of the DA Form 5618-R is in Appendix A. You may reproduce this form on 8 1/2 x 11-inch paper.

CONDUCTOR'S WHEEL REPORT
For use of this form, see FM 55-20. The proponent agency is TRADOC.

TRAIN NO.	DIRECTION	UNIT	PAGE	OF	PAGES
3	West	714th	1	1	

ENGINE	CABOOSE OR BRAKE VAN	DEPARTING STATION	DEPARTING TIME	DEPARTING DATE	ARRIVING STATION	ARRIVING TIME	ARRIVING DATE	CONDUCTOR
1819	995	James	0815	1 FEB '99	Hanks	0845	1 FEB '99	J. M. Gray

INITIAL	NUMBER	TYPE	TAKEN AT	LEFT AT	DATE	LINE	CONTENTS	DESTINATION	REMARKS
USA	82130	B	James	Chessie	1 Feb	1	MTY	WYE	NONE
USA	93241	G	James	Hanks	1 Feb	2	CL IV	HANKS	NONE
USAX	67096	F	Chessie	Hanks	1 Feb	3	CL II	HANKS	#3 WHEEL-FLAT
USAX	25463	B	Chessie	WYE	1 Feb	4	CL V	WYE	NONE
DCDX	14001	T	James	Chessie	1 Feb	5	POL	Chessie	NONE
						6			
						7			
						8			
						17			
						18			
						19			
						20			
						21			
						22			
						23			
						24			

SAMPLE

DA FORM 5618-R, DEC 86

Figure 5-5. Sample DA Form 5618-R

SETOFFS AND PICKUPS

5-45. The head brakeman usually does the work involved in setting off and picking up cars en route. He gets permission from the yardmaster or dispatcher when making these car movements at yards and stations, and delivers and gathers waybills for cars that the train leaves and picks up. When necessary to cross main tracks against the current of traffic, the head brakeman must assume head-end flagging duties. When the train leaves the area, switches and derails must be relocked and left in their original or normal positions.

5-46. The conductor is responsible for the set out report. It is normally prepared in triplicate and routed to the division superintendent (battalion commander) through the chief dispatcher and the division master. The division superintendent and chief dispatcher will retain a copy. The master mechanic ensures that all repairs are made and the dispatcher arranges pickup.

5-47. DA Form 5615-R (Figure 5-6) shows the following information:

Location. Self-explanatory.

To. Indicate closest car repair facility.

Date. Enter current date.

Train No. Indicate train number.

Time. Show current time.

Date. Show current date.

Car No. and Initial. Self-explanatory.

Commodity. Indicate class of supply carried by freight car.

Set Out At. Indicate where car was set out.

Reason for Set Out. Self-explanatory.

Consignor. Self-explanatory.

Point of Origin. Self-explanatory.

Consignee. Self-explanatory.

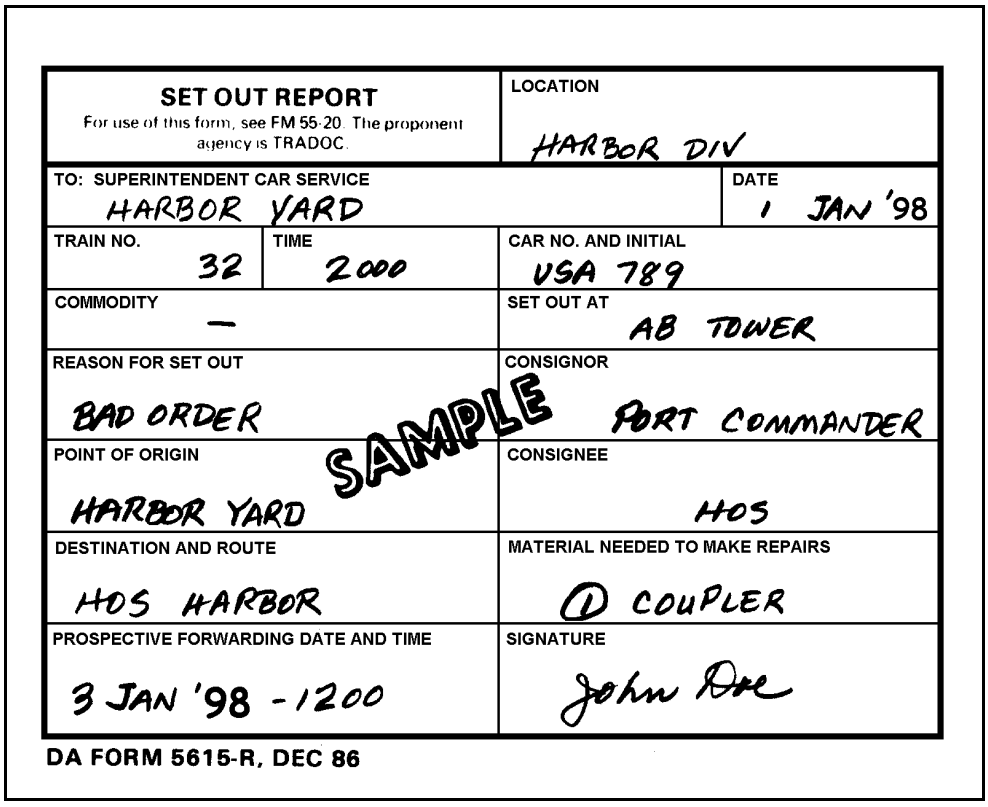
Destination and Route. Self-explanatory.

Material Needed to Make Repairs. Indicate quantity and type of repair parts.

Prospective Forwarding Date and Time. Indicate date and time that car is expected to reach destination.

Signature. Self-explanatory.

Note: A blank copy of DA Form 5615-R is shown in Appendix A. You may reproduce this form on 8 1/2 x 11-inch paper.



SET OUT REPORT For use of this form, see FM 55-20. The proponent agency is TRADOC.		LOCATION HARBOR DIV
TO: SUPERINTENDENT CAR SERVICE HARBOR YARD		DATE 1 JAN '98
TRAIN NO. 32	TIME 2000	CAR NO. AND INITIAL USA 789
COMMODITY —		SET OUT AT AB TOWER
REASON FOR SET OUT BAD ORDER		CONSIGNOR PORT COMMANDER
POINT OF ORIGIN HARBOR YARD		CONSIGNEE HOS
DESTINATION AND ROUTE HOS HARBOR		MATERIAL NEEDED TO MAKE REPAIRS ① COUPLER
PROSPECTIVE FORWARDING DATE AND TIME 3 JAN '98 - 1200		SIGNATURE John Doe

SAMPLE

DA FORM 5615-R, DEC 86

Figure 5-6. Sample DA Form 5615-R

NATO RAIL TRANSPORT REQUESTS

5-48. When operating in the NATO arena, request rail transport to move US troops and equipment according to AMovP2.

SAFETY MEASURES

5-49. The safe movement of a train depends on the untiring watchfulness of the entire crew. The responsibility of watching for signs of trouble rests equally on each crew member. The engine crew is responsible for observing the track ahead and the conductor and flagman (rear brakeman) are responsible for protecting the train from collision at the rear. Crew members (at each end of the train) are also responsible for the following:

- Looking for hot journals.
- Shifting loads.
- Opening doors on boxcars and refrigerator cars.
- Dragging rigging.
- Other safety hazards.

These duties are best performed when the train is rounding curves and 30 to 50 percent of either end of the train is visible alternately from the engine. Other activities of the crew to keep a train safe and prevent accidents are discussed in the following paragraphs.

FLAGGING

5-50. From a safety standpoint, the flagman's duties and responsibilities are equal to those of the engineman. Proper flagging and prompt compliance by enginemen are the only known means of preventing rear-end collisions on sections of railroad not protected by automatic train control.

SIGNAL LAMP MARKERS

5-51. An important duty of the flagman is to light, hang, and turn train markers. Markers are signal lamps displayed on the rear of a train. They have four opposing lenses: one is red and the others are yellow or green. The markers are placed on hangers and may be turned to show any of the colors or a combination of them. The flagman mounts the markers to show red to the rear when running on the main track with the current of traffic. When the train takes a siding, he reverses the markers to show yellow or green to the rear. If the flagman drops off the moving train to do flagging duties when entering a siding, the conductor must reverse the markers. The marker colors indicate to the engineman of a following train whether the train ahead is on the main or in a siding.

TRAIN OBSERVATION

5-52. The conductor and flagman spend much of their time looking over the train, the adjacent tracks, and the right-of-way. The observer is continually on the alert for smoke, the acrid odor of a hotbox (an overheated journal), or sticking brakes. A hotbox gives off brown smoke, while sticking brakes give off bluish smoke. If a hot journal is discovered, the train must be stopped and the car examined. It is often necessary to cool the journal, add fresh oil and packing, and set the car off at the next opportunity. Damage to the bearing and journal is not the chief danger resulting from a hotbox. If permitted to run unattended, it may become so hot that the axle could break, drop to the ties, and derail the train. The dispatcher must be notified when a hot journal is set off en route, and the waybill must be endorsed showing the trouble and the disposition of the car. To keep the waybill and car together, the waybill must be left at the next office following the point where the car was set off. The head brakeman keeps watch from the head end. When trains are met or passed on adjoining tracks, the engine crew has little clearance to observe the other train. If one or two clear tracks separate the trains, the head-end crew scans the other train when passing. They watch for signs of hotboxes, dragging brake rigging, contents leaking from cars, shifted loads, and open doors on boxcars and refrigerator cars. They also watch for pilferers and trespassers.

HAND SIGNALS

5-53. A unique system of hand signals has developed on most railroads to inform other crews of safety hazards. They are not found in the operating rules or in the timetable, but they are well understood by road crews who often use them to their advantage. When trains meet, the conductor or flagman of each train stands on the rear platform looking over the other train. As the trains pass, the crews wave an okay or give a stop sign. The stop sign is often followed by another signal denoting the specific trouble. These signs are usually peculiar to a particular railroad. One that appears to have fairly wide acceptance is squeezing the nose between the thumb and forefinger to indicate the unpleasant odor of a hotbox. Another is holding the hands at arm length and sliding one palm across the other to signify a sliding wheel.

EMERGENCY STOP SIGNALS

5-54. When a train is passing a defective train, a signal must be given to the engine crew when passing the engine. If the defect is serious or if there is any doubt that the signal is clearly understood, someone on the passing engine may throw off a lighted fuse in the path of the overtaken train. This will cause the train in question to stop and investigate the trouble before proceeding. The crew throwing off the fuse may throw off a written message at the next station advising the dispatcher of their action and of the trouble with the train they passed.